United States Department of the Interior
National Park Service

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date entered

National Register of Historic Places Inventory—Nomination Form

See instructions in *How to Complete National Register Forms*
Type all entries—complete applicable sections

1. Name

historic Masonry Arch Bridges of Kansas

and/or common N/A

2. Location

street & number See individual nomination forms N/A not for publication

city, town N/A ___ vicinity of N/A

state N/A code N/A county N/A code N/A

3. Classification

Category	Ownership	Status	Present Use	
___ district	___ public	x occupied	___ agriculture	___ museum
___ building(s)	___ private	x unoccupied	___ commercial	___ park
___ structure	x both	___ work in progress	___ educational	___ private residence
___ site	**Public Acquisition**	**Accessible**	___ entertainment	___ religious
___ object	___ in process	x yes: restricted	___ government	___ scientific
x thematic	___ being considered	x yes: unrestricted	___ industrial	x transportation
		___ no	___ military	___ other:

4. Owner of Property

name Multiple ownership -- see individual nomination forms.

street & number N/A

city, town N/A ___ vicinity of N/A state N/A

5. Location of Legal Description

courthouse, registry of deeds, etc. See individual nomination forms.

street & number N/A

city, town N/A state N/A

6. Representation in Existing Surveys

title Inventory of Historic Bridges
Kansas Department of Transportation has this property been determined eligible? ___ yes x no

date 1980-1983 ___ federal x state ___ county ___ local

depository for survey records Kansas State Historical Society

city, town Topeka state KS 66612

7. Description

See individual nomination forms.

Condition		Check one	Check one
___ excellent	___ deteriorated	___ unaltered	___ original site
___ good	___ ruins	___ altered	___ moved date ___
___ fair	___ unexposed		

Describe the present and original (if known) physical appearance

The Kansas Department of Transportation (KDOT) carried out a statewide inventory of historic bridges between 1980 and 1983. The bridges to be included were identified through computer printouts developed by KDOT, from information supplied by the counties (since almost all of the historic bridges were located on secondary rather than the primary road system), and by direct observation by field personnel. All bridges were inspected by KDOT personnel, and all of the bridges included in this thematic nomination were inspected by staff of the Kansas State Historical Society (KSHS).

All of the bridges included in the four subclasses which together make up the Masonry Arch Bridges of Kansas thematic nomination were jointly evaluated by representatives of KDOT, KSHS, and the State Historic Preservation Officer.

Most of the bridges in each subclass are alike or quite similar in their methodology and techniques of construction. Little historical information is available on many of these small bridges. For example, the designer, builder, and date of construction are not known on a large number of the inventoried bridges in these classes. Often bridge plaques which may have contained that information have been removed, or the county's records are not complete or have been destroyed. Many times there is little to choose from in differentiating among individual bridges of these subclasses other than condition and the likelihood of preservation. Technology and individual historical significance are usually not factors.

The purpose of the KDOT survey and the subsequent evaluation was to identify a representative selection of bridges of each class or subclass and nominate to the National Register those candidates which meet the criteria of eligibility. Through this approach KDOT and KSHS hope to preserve for posterity some examples of each type of bridge.

* * * * * * * * * * * * * *

The bridges included in this nomination are representatives of the arch bridge class. This class is made up of stone arches, reinforced concrete arches, filled spandrel concrete arches and open spandrel concrete arches. These categories represent 17.5% of the identified historic bridges in Kansas.

7. DESCRIPTION Continued

The stone arch bridges included in this nomination consist of limestone arch rings which spring from and are disposed between abutments or piers. Limestone spandrel walls rest on these arch rings and are used to retain the earthen fill which loads the arch. This earth loading allows for even distribution of the live loads and helps to strengthen the arch. The structural design of the filled spandrel concrete arch bridge is similar. Instead of limestone arch rings, spandrel walls, piers, and abutments, reinforced concrete is substituted. The earthen fill remains the same. In some instances, reinforcement was increased and concrete was utilized as the fill. We refer to these bridge simply as reinforced concrete arches. In the case of an open spandrel arch, the reinforced concrete arch ring or rings spring from and are disposed between the abutments or piers. The roadway deck is supported by reinforced concrete cross-spandrel walls or columns that rest on the arch ring or rings. No spandrel walls are used.

The nominated bridges include examples of variations and combinations of the above types. The North Branch Otter Creek bridge features limestone ring stones and spandrel walls with a concrete arch ring. The Landers Creek bridge consists of a limestone arch ring with concrete spandrel walls. The Brush Creek and Jake's Branch bridges combine the use of corrugated metal and concrete to form the arch ring, while limestone is used to form the spandrel walls and ringstones.

7. DESCRIPTION Continued

Listed below, by subclass, are the thirty-two bridges which make up this thematic nomination:

Stone Arch

Polecat Creek Bridge, 5 miles west and 2 miles south of Douglass, Butler County

Esch's Spur Bridge, 3 miles south and 3 miles west of Dexter, Cowley County

Middle Creek Tributary Bridge, 1½ miles south and ¼ mile east of Homewood, Franklin County

North Branch Otter Creek Bridge, 2 miles south and 8½ miles west of Climax, Greenwood County

Bullfoot Creek Bridge, 4 miles south and 1 mile east of Vesper, Lincoln County

Spring Creek Tributary Bridge, 8 miles south and 5 miles east of Lincoln, Lincoln County

Lander's Creek Bridge, south edge of Goodrich, Linn County

Morton County WPA Bridge (Bear Creek Masonry Bridge), 3 miles north and 6 miles west of Richfield, Morton County

Pawnee River Tributary Bridge, 8 miles south of Bazine, Ness County

Vermillion River Tributary Bridge, 5 miles south and 1 mile east of Onaga, Pottawatomie County

Rush-Russell County Line Bridge, 11 miles north of Otis, Rush County

Brush Creek Bridge, ½ mile south of Coyville, Wilson County

Filled Spandrel

Cottonwood River Bridge, north edge of Cottonwood Falls, Chase County

Hudgeon Bridge, 10 miles south and 3¼ miles west of Girard, Crawford County

Parsons Labette Creek Tributary Bridge, 1 mile east and 1¼ miles south of Parsons, Labette County

7. DESCRIPTION Continued

Harris Bridge, 3 miles north and 4 miles west of Americus, Lyon County

Maxwell's Slough Bridge, 1 mile south of St. Paul, Neosho County

Cut-Off Bridge, 6¼ miles south and 1 3/4 miles east of St. Paul, Neosho County

Township Line Bridge, 3 miles west of Rozel, Pawnee County

McCauley Bridge, ½ mile south of Auburn, Shawnee County

Open Spandrel

Verdigris River Bridge, ½ mile north of Madison, Greenwood County

Hackberry Creek Bridge, 12 miles west and 11 miles north of Jetmore, Hodgeman County

Reinforced Concrete Arch

Muddy Creek Bridge, 3 miles east and 1 mile north of Douglass, Butler County

(Butcher Bridge)
Eight Mile Creek Bridge, 1½ miles north and 2 miles west of Rock, Cowley County

Walnut Creek Bridge, 1½ miles south of Wellsville, Franklin County

Belvidere Medicine River Bridge, north edge of Belvidere, Kiowa County

Labette Creek Tributary Bridge, west edge of Parsons, Labette County

Pumpkin Creek Tributary Bridge, 2 miles west of Mound Valley, Labette County

Jake's Branch Bridge, 6 miles south and 1 mile west of Louisburg, Miami County

Pennsylvania Avenue Rock Creek Bridge, south edge of Independence, Montgomery County

State Street Bridge, east edge of Erie, Neosho County

Old Maid's Fork Bridge, 2 miles west and ½ mile north of Nekoma, Rush County

8. Significance

Period	Areas of Significance—Check and justify below			
___ prehistoric	___ archeology-prehistoric	___ community planning	___ landscape architecture	___ religion
___ 1400–1499	___ archeology-historic	___ conservation	___ law	___ science
___ 1500–1599	___ agriculture	___ economics	___ literature	___ sculpture
___ 1600–1699	___ architecture	___ education	___ military	___ social/ humanitarian
___ 1700–1799	___ art	___ engineering	___ music	___ theater
_x_ 1800–1899	___ commerce	___ exploration/settlement	___ philosophy	_x_ transportation
_x_ 1900–	___ communications	___ industry	___ politics/government	___ other (specify)
		___ invention		

Specific dates See individual forms **Builder/Architect** See individual forms

Statement of Significance (in one paragraph)

The individual components of the thematic nomination "Masonry Arch Bridges of Kansas" possess integrity of location, design, setting, workmanship, feeling, and association and meet criterion C of the National Register eligibility requirement: "that embody the distinctive characteristics of a type, period, or method of construction, ..."

Stone arch bridges were popular in Kansas for many reasons, a major one being that the stone was often available locally. Thus a larger amount of the money expended for the construction could be retained within the area than would be true with the purchase of a metal structure. It was also often possible to use local workers on the project. This approach sometimes had its drawbacks as the quality of local stone and workers would vary widely. Generally speaking, stone bridges were more expensive initially to construct than metal bridges. Walter Sharp, a major stone arch contractor in Kansas, estimated the cost differential at 10% in 1904, although this too was somewhat misleading. Those contractors proposing steel bridges would often lower their bids $100-$500 when they found themselves as competitors to stone contractors. An additional selling point for stone bridges was their strength. There was ample evidence that they were far better able to withstand the periodic floods than were their metal counterparts.

The relatively low cost and widespread fabrication of iron and steel bridges in the 19th century and their overrated permanence put them slightly ahead in sales. By the first decade of the twentieth century, however, the combination of steel and masonry and the economic production of cement in Kansas promoted a rapid return to masonry construction.

Many claims were made for concrete and the positive aspects of its use in bridge building. It was said to be a permanent material, far more durable than stone, and one which actually increased in strength with age. A concrete bridge was said to be frostproof, fireproof and floodproof. The concrete, it was thought, would permanently protect the steel. In the arch bridge the support for the roadway is below, and it was felt that the roadway could be widened without destruction of the original investment, with the possible exception of the railing.

Although concrete, in itself, is far from an aesthetically pleasing compound, it can be moulded into intricate designs. Decorative ornamental features, which would have been prohibitive costwise for a community planning a bridge in any other medium, now became possible.

8. SIGNIFICANCE Continued

Local labor gangs were often employed by contractors so again much of the construction expense remained within the community. The use of local aggregates could also significantly reduce the cost of a structure as did the availability of Kansas produced cement. Some contractors, such as Walter Sharp, even purchased rock crushers and used local fence stone. It is not surprising that the quality of the final product bore a direct relationship to the quality of the cement and aggregate used in the construction.

The vast majority of the early reinforced concrete structures were built from patented designs. These patents actually related more to the placement and type of reinforcement than to the outside appearance of the bridge.

The person with the largest number of such patents was Daniel B. Luten of Indianapolis, Indiana. His company, the National Bridge Company, and its Kansas agent, Topeka Bridge and Iron Company, were responsible for the greatest number of filled spandrel and reinforced concrete bridges in the state.

Luten was granted many patents dealing with various aspects of reinforced concrete arch bridge construction. He was granted so many patents in fact that he was able to tell the Kansas Engineering Society in 1914 that "A safe and durable concrete bridge can undoubtedly be erected without infringing any patent. But it is a serious question whether a reinforced concrete arch can be erected without infringement." Although the royalty figures varied, the Luten Engineering Company usually claimed 10% of the contract if any of their patents were used.

Because it was virtually impossible to build a reinforced concrete arch bridge without using one of his patents, the royalty costs for bridge companies, states, counties and municipalities became burdensome. The company was continuously involved in litigation throughout the midwest. A number of lawsuits charging patent infringement were filed in Kansas by Luten's attorneys against local units of government. The issue was not settled until 1918 when the state attorney general successfully argued that Luten's patents were invalid, and the cases were dismissed.

No attempt will be made to discuss all of the intricacies of Luten's patents and construction details as modifications were made over the years. One of his first was patent #649,643, granted May 15, 1900. It consisted of uniting the abutments of an arch bridge by means of a tie or ties placed beneath the water line of the structure. This relieved the abutments of some horizontal strain and provided a foundation for the bridge. At the same time the ties were concealed from view, offered no obstruction to flow, and prevented stream bed scouring. Luten initially recommended the use of timber as he felt this was practically permanent if placed under water. In later refinements the ties were steel and covered with concrete. This "floodproofing pavement" allowed the bridge to be constructed without pilings or even soil foundations. This enabled a saving in initial construction as one could decrease the amount of material in the abutments.

8. SIGNIFICANCE Continued

It also gave a solid support for centering and the aprons along the edge of the pavement extending several feet into the stream bed rendered the bridge virtually "floodproof."

A patent filed May 17, 1902 [818,386] gives the basic reinforcement theory of Luten Arches. It was an arch having "embedded therein a plurality of tension members passing alternately across the rib, said members being low at the crown and high at the haunches, and each of said members passing alternately across the rib at different longitudinal points from the others." The theory was that the tension would occur at alternately opposite edges of the arch in limited regions only. The steel was located in those regions and extended continuously from one end to the other for convenience of placement.

Topeka Bridge and Iron was responsible for the construction of a great number of the filled spandrel and reinforced concrete bridges in Kansas. The company used both the Luten designs as well as a patent obtained by Lloyd B. Smith of Topeka. Without the destruction of a bridge it would be impossible to determine whose reinforcement design was employed.

Smith had worked for four years as assistant engineer with Missouri Valley Bridge and Iron Works in Leavenworth before coming to Topeka in 1904 as chief engineer of Topeka Bridge and Iron. That company initially manufactured steel bridges at its shops in Topeka, but that fabrication was discontinued in 1914 due to unsatisfactory freight rates and the increased demand for concrete bridges. Adapting to the changes, the company continued as a construction company chiefly involved in concrete bridges and deep foundations. In addition to his bridge patent, Smith received four others for river bank protection.

The final type of construction being presented is the open spandrel type. It is difficult at this time to determine why this particular style might have been selected over the filled arch design. Several considerations often went into its selection. The solid earth fill was generally used for small spans and flat arches. If, however, the arch was large and especially semicircular, the open construction was found to be less expensive. In other instances it was selected, even when it was more expensive, to reduce the load on the foundations. It is also possible by selecting either the solid or open spandrel type to adjust the imposed loads on the arch to the type desired. The loads on the arch rings with open cross spandrel chambers or arcades are concentrated loads. The distribution of loads in earth filled arches was uncertain in most cases. In addition to preventing this uncertainty the open spandrel construction also prevented water from collecting and soaking into the arch masonry. The style could also be used as an aesthetic feature. By building open chambers crosswise and having the openings appear on the spandrel faces, the design presented a lighter appearance and at the same time showed plainly the plan of construction. When a heavier and more massive appearance was desired sidewalls were used and all the spandrel openings closed. These curtain walls could be thinner and hence less expensive than the retaining walls of the earthen filled structures. Because both the colonnade and arcade styles left major portions of the bridge's substructure exposed more finishing and architectural treatment was often deemed necessary.

8. SIGNIFICANCE Continued

Although an arch is merely a means of transforming generally vertical, or nearly vertical, loads into diagonal thrusts, the masonry-concrete arch bridge is more than a strictly utilitarian structure. The remaining examples exhibit construction techniques no longer utilized. They are the physical remains of experiments in the evolution of concrete reinforcement and patented theories, as well as the legal battles involved in protecting those patents. They were constructed using local funds and when possible local labor and natural resources. They are also major remnants of the "good roads" movement within the state. By the turn of the century the ever expanding needs for readily available markets impressed upon Kansans the necessity of all-weather roads as well as safe and secure river crossings.

Henry Tyrrell, the author of Artistic Bridge Design, concluded that "the bridges and structures erected by a people or nation reveal their degree of aesthetic taste and are a measure of their culture and civilization. Bridges should be strong enough to last and beautiful enough to be worth preserving." The nominated bridges are worth preserving.

THIS STATEMENT REFLECTS CURRENT KNOWLEDGE AND IS SUBJECT TO AMENDMENT

9. Major Bibliographical References

See continuation sheet.

10. Geographical Data

Acreage of nominated property See individual forms

Quadrangle name See individual forms

Quadrangle scale See individual forms

UTM References See individual forms

A Zone Easting Northing

B Zone Easting Northing

C

D

E

F

G

H

Verbal boundary description and justification

See individual forms

List all states and counties for properties overlapping state or county boundaries

state N/A code county code

state code county code

11. Form Prepared By

name/title Larry Jochims, Research Historian

organization Kansas State Historical Society date 4-4-85

street & number 120 West Tenth telephone 913-296-3251

city or town Topeka state KS 66612

12. State Historic Preservation Officer Certification

The evaluated significance of this property within the state is:

___ national x state ___ local

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89–665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

State Historic Preservation Officer signature Joseph W. Snell

title Executive Director, Kansas State Historical Society date April 23, 1985

For NPS use only

I hereby certify that this property is included in the National Register

date

Keeper of the National Register

Attest: date

Chief of Registration

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